What is claimed:

1. A process for producing nano-sized stabilized zirconium dioxide that comprises:

a. providing an aqueous solution that includes a zirconium salt and a stabilizing agent;

b. hydrolyzing the solution to form an intermediate, in a controlled temperature, substantially total evaporation process at a temperature higher than the boiling point of the solution but lower than the temperature where there is significant crystal growth; and,

c. calcining the hydrolyzed product to form nano-sized agglomerates.

2. The process of claim 1 wherein the zirconium salt is selected from the group consisting of zirconium oxysulfate, zirconium oxychloride, zirconium nitrate, and a water-soluble stabilizing agent.

3. The process of claim 1 wherein the stabilizing agent is selected from the group consisting of yttrium chloride, cerium chloride, calcium chloride, magnesium chloride, and rare earth oxides.

4. The process of claim 1 wherein the hydrolyzing step successively evaporates part of the solution, hydrolyzes the zirconium in solution, and substantially totally evaporates the remainder of the solution.

5. The process of claim 1 wherein during the hydrolyzing step, hydrochloric acid is formed and water is removed.

6. The process of claim 5 wherein the hydrochloric acid and water are recovered.

7. The process of claim 1 wherein the hydrolyzing is effected in a spray dryer.

8. The process of claim 7 wherein the spray dryer temperature is between about 120° C and about 350° C.

9. The process of claim 1 where a thin film of amorphous zirconia is formed as a result of the hydrolysis process.

10. The process of claim 9 wherein the amorphous zirconia comprises spheres or parts of spheres with thin membranes having a diameter between about 1 and about 100 μm and a membrane thickness between about 30 nm and about 1000 nm.

11. The process of claim 1 wherein the calcining is conducted at a temperature between about 400° C and about 1300° C.

12. A process for producing nano-sized stabilized zirconium dioxide having a crystallite particle size less than about 100 nm that comprises

a. providing an aqueous solution that includes zirconium oxychloride and a stabilizing agent;

b. hydrolyzing the solution to form an intermediate in a controlled temperature substantially total evaporation process at a temperature higher than the boiling point of the solution but lower than the temperature where there is significant crystal growth; and,

c. calcining the hydrolyzed product to form nano-sized agglomerates.

13. The process of claim 12 wherein the hydrolyzing step successively evaporates part of the solution, hydrolyzes the zirconium and stabilizing agent together, and substantially totally evaporates the remainder of the solution.

14. The process of claim 12 wherein during the hydrolyzing step, hydrochloric acid is formed and water is removed.

15. The process of claim 14 wherein the hydrochloric acid and water are recovered.

16. The process of claim 12 wherein the hydrolyzing is effected in a spray dryer.

17. The process of claim 16 wherein the spray dryer temperature is between about 120° C and about 350° C.

18. The process of claim 12 where a thin film of amorphous zirconia is formed as a result of the hydrolysis process.

19. The process of claim 18 wherein the amorphous zirconia comprises thin film membrane spheres having a diameter between about 1 and about 100 μm and a membrane thickness between about 30 nm and about 1000 nm.

20. The process of claim 12 wherein the calcining is conducted at a temperature between about 400° C and about 1300° C.